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1 10. An apparatus comprising:  
2 a movable pick-up head capable of holding, positioning and releasing a die,  
3 the die having an alignment mark;  
4 a panel support member adapted to movably support a panel in a panel  
5 support plane, the panel having upper and lower surfaces and an array of cavities  
6 each open at the upper surface and each having a transparent bottom;  
7 a transparent plate with fiducials arranged at locations corresponding to  
8 desired die locations, the transparent plate arranged adjacent the panel support plane  
9 opposite the movable pick-up head; and  
10 an optical vision system adapted to image at least one fiducial and generate  
11 an electrical signal corresponding to the position of the at least one fiducial.

1 11. The apparatus of claim 10, further including a controller electrically  
2 connected to the pick-up head and the optical vision system, the controller adapted  
3 to control the movement of the pick-up head in response to the electrical signal.

1 12. The apparatus of claim 10, wherein the transparent plate is made of glass.

1 13. The apparatus of claim 11, wherein the glass is quartz.

1 14. The apparatus of claim 10, wherein the fiducials are formed by electron-  
2 beam lithography.

1 15. A method comprising:  
2 providing a panel with a plurality of cavities, each cavity including an  
3 opening to a panel upper surface and a transparent bottom at a panel lower surface;  
4 arranging adjacent the panel lower surface a transparent plate having an  
5 upper surface with a plurality of fiducials formed thereon, with one fiducial aligned  
6 with the each cavity transparent bottom and serving as a local fiducial; and  
7 imaging the local fiducial to align the die to the cavity.

1 16. The method of claim 15, further including determining a position of the die  
2 relative to the local fiducial based on said imaging.

1 17. The method of claim 16, including generating an electrical signal  
2 corresponding to the die position relative to the local fiducial.

1 18. The method of claim 17, further including aligning the die with the local  
2 fiducial.

1 19. The method of claim 18, further including:  
2 inserting the die into the opening of the cavity associated with the local  
3 fiducial; and  
4 contacting the die to the transparent bottom.

1 20. The method of claim 15, including forming the fiducials using electron-  
2 beam lithography.

1 21. A method comprising:  
2 forming fiducials on an upper surface of a transparent plate;  
3 arranging the transparent plate relative to a panel having multiple cavities  
4 formed in a panel upper surface, with each cavity having a transparent bottom, said  
5 arranging including aligning each fiducial beneath a corresponding one of the  
6 multiple cavities; and  
7 imaging a select one of the fiducials corresponding to a select one of the  
8 cavities to establish a die position relative to the select one of the cavities.

1 22. The method of claim 21, including making the transparent bottom adhesive.

1 23. The method of claim 21, including aligning the die alignment mark to the  
2 select fiducial.

1 23. The method of claim 23, further including placing the die onto the  
2 transparent bottom of the select cavity.

1 24. The method of claim 21, including imaging the die alignment mark  
2 through the transparent bottom.

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